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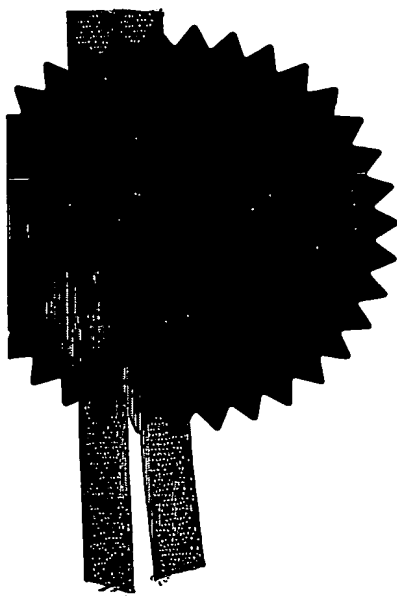
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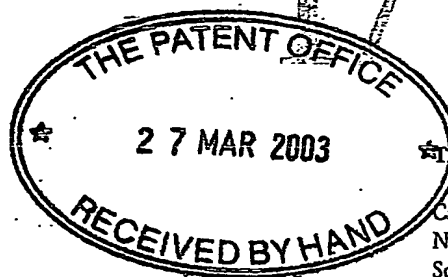
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1. Your reference	P17504GB-LH/mf		
2. Patent application number (The Patent Office will fill in this part)	0307120.6	28MAR03 E795827-4 D00389 P01/7700 0.00-0307120.6	27 MAR 2003
3. Full name, address and postcode of the or of each applicant (underline all surnames)	Minebea Co. Ltd., 4106-73 Oaza Miyota, Miyota-machi, Kitasaku-gun, Nagano 389-0293, Japan. Patents ADP number (if you know it) 4246831000 If the applicant is a corporate body, give the country/state of its incorporation Japan		
4. Title of the invention	A Bush and Method of Manufacturing a Bush		
5. Name of your agent (if you have one)	Forrester Ketley & Co.		
"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode)	Forrester House 52 Bounds Green Road London N11 2EY		
Patents ADP number (if you know it)	133001		
6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and (if you know it) the or each application number	Country	Priority application number (if you know it)	Date of filing (day / month / year)
7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application	Number of earlier application	Date of filing (day / month / year)	
8. Is a statement of inventorship and of right to grant of a patent required in support of this request? (Answer 'Yes' if: a) any applicant named in part 3 is not an inventor, or b) there is an inventor who is not named as an applicant, or c) any named applicant is a corporate body. See note (d))	NO		

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Description

6

Claim(s)

3

Abstract

1

Drawing(s)

3

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Priority documents

NONE

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Statement of inventorship and right to grant of a patent (Patents Form 7/77)

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Request for preliminary examination and search (Patents Form 9/77)

1

Request for substantive examination (Patents Form 10/77)

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Any other documents (please specify)

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11.

I/We request the grant of a patent on the basis of this application.

Forrester Ketley & Co.

Signature

Date

27 March 2003

Forrester Ketley & Co.

12. Name and daytime telephone number of person to contact in the United Kingdom

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DUPLICATE

PATENTS ACT 1977.

Agents Ref: P17504GB-LH/mf

5 **A BUSH AND METHOD OF MANUFACTURING A BUSH**

This invention relates to a bush and a method of manufacturing a bush, and more particularly to a method of manufacturing a lined and flanged bush and to a lined and flanged bush manufactured according to the method.

10

Blow-down panel bushes are used in aerospace applications and comprise a flanged bush to which a ring of self-lubricating liner is bonded. The component is manufactured and machined on a piece-by-piece basis and is small, standing approximately 4mm high with a rounded rectangular base being
15 approximately 20mm long and 16mm wide.

Once the flanged bush has been machined to provide a spigot with a central bore upstanding from the surrounding flange surface, the ring of self-lubricating liner is cut to size and bonded to the flange surface. Great care must
20 be taken to ensure that a constant and consistent pressure is applied to the liner to effect a good adhesive bond between the liner and the flange surface. After bonding is complete, the outer edge of the ring of self-lubricating liner must be trimmed to ensure that no part of the liner protrudes beyond the edge of the flange surface and to ensure that there is no fretting of the liner edge. It is
25 imperative that the liner edge is fully bonded right up to the edge of the flange surface.

With such small pieces of manufacture, it is difficult to maintain a good quality finished product. The manufacturing process is labour-intensive, involves many steps and is also expensive.

- 5 It is an object of the present invention to ameliorate the above-mentioned disadvantages.

Accordingly, one aspect of the present invention provides a method of manufacturing a method of manufacturing a bush from a blank comprising the steps of: providing a blank having a surface to be lined and at least one spigot
10 upstanding from the surface; providing a liner having an aperture; locating the aperture in the liner around the spigot such that the liner lies on the surface; and stamping out the blank around the spigot to provide a lined and flanged bush.

- 15 A further aspect of the present invention provides a flanged bush comprising: a spigot having a flange which provides a flange surface surrounding the spigot; and a liner having an aperture through which the spigot is located, wherein there is an adhesive bond between the flange surface and the liner and a mechanical bond between an outer edge of the liner and the edge of the flange.

20

In order that the present invention may be more readily understood, embodiments thereof will now be described, by way of example, with reference to the accompanying drawings, in which:

- 25 Figure 1 is plan view of a flanged bush embodying the present invention;

Figure 2 is a cross-section through the bush of Figure 1 taken along line A-A;

Figure 3 is a plan view of a billet of material machined to provide an array of upstanding spigots;

5 Figure 4 is a plan view of a self-lubricating liner for use with the billet of Figure 3;

Figure 5 is a plan view of the liner of Figure 4 registered with the billet of Figure 3 and showing the intended punch lines for individual bushes; and

10 Figure 6 is a detail of the bush of Figure 2.

Referring to Figures 1 and 2, a flanged bush 1 embodying the present invention is configured, in this case, as a blow-down panel bush and comprises a spigot 2 surrounded by a flange 3. The spigot 2 and flange 3 are substantially
15 rectangular in plan view, the corners of the rectangles being rounded as shown in Figure 1. A central bore 4 runs through the spigot 2.

A ring of self-lubricating liner 5 such as a PTFE enriched woven metal or plastic mesh reinforced by resin sits on the flange surface 6 surrounding the
20 spigot 2. The spigot 2 passes through an aperture 7 in the ring of liner material. There is a clearance gap 8 between the spigot 2 and the liner 5. The liner 5 is adhesively bonded to the flange surface 6.

A method embodying the present invention for manufacturing a bush as shown
25 in Figures 1 and 2, comprises the following steps. Firstly, a bar of steel is cut to provide a billet 10 which will provide a blank from which the method embodying the present invention will provide, in this example, ten flanged bushes 1.

Referring to Figure 3, one surface of the billet 10 is machined to leave ten upstanding spigots 2 in a regular array across the surface of the billet 10. A central bore 4 is machined through each of the spigots 2. Further, a pair of registration holes 11 are drilled through the billet 10. The registration holes 11 are provided on different radial axes so as not to be symmetrical with one another about any axis of the billet 10.

Referring now to Figure 4, a sheet of self-lubricating liner 5 is provided into which are cut ten apertures 7 dimensioned to surround, with a clearance gap 8, each of the spigots 2. The apertures 7 in the liner are arranged in the liner sheet so as to register with the spigots 2 on the billet 10.

The liner 5 is also provided with two registration holes 12, which are intended to be aligned with the registration holes 11 on the billet 10 when the spigots 2 pass through their respective apertures 7 in the liner 5.

An adhesive is applied to the liner 5 and the billet surface or the liner 5 may comprise a self-adhesive surface on the surface of the liner 5 facing the surface of the billet 10.

Registration pins 13 are located in registration holes 11 and the liner 5 is laid over the billet 10 lining up the registration holes 12 with the registration pins 13 until the liner sits on the surface of the billet 10 with the spigots 2 protruding through the apertures 7 in the liner 5.

The liner 5 and the billet 10 are pressed together and a consistent and constant pressure is applied over the large surface area of the liner 5 pushing the liner 5 and billet 10 together to ensure a good adhesive bond between the liner 5 and

the billet 10 over the complete surface area of the billet. It is much easier to provide a consistent pressure over the relatively large surface area of a billet 10 containing an array of many spigots 2 then over a ring of liner on a single flanged bush 1.

5

Referring now to Figure 5, the billet 10 and liner 5 are placed in a stamping machine which is arranged to punch out simultaneously ten flanged bushes 1 from the billet 10. In Figure 5, there is a dashed line 14 drawn around each of the spigots 2. This line comprises the punch line 14 or the line of cut which the stamping machine will create, effectively being the outline 14 of each of the flanged bushes 1.

The remaining surface of the billet 10 is punched away from the outlines 14 of the flanged bushes 1 leaving the flanged bushes 1 remaining. The stamping process cuts firstly through the liner 5 and then the material of what will comprise the flange 3 so that there is an element of compression of the liner 5 at the very edge of the flange surface and, indeed, the shearing action of the punching or stamping step creates a mechanical bond between the liner 5 and the flange 3 at the punch line 14, thus ensuring that the liner 5 is fully bonded around the edge of the flange to the flange.

The stamping operation means that the previous manufacturing steps, used to produce a conventional panel bush, of trimming the liner 5 around the edge of the flange and removing the excess glue from between the liner and the edge of the flange are no longer required. The shearing action of the stamping or punching step means that the liner is very neatly finished with respect to the edge of the flange 3 and, as shown in Figure 6, particularly when a metal mesh is used in the liner 5, there is an element of a mechanical bond 15 between the

liner 4 and the flange 3 at the point of contact between the liner 5 and the flange 3 around the edge of the flange 3.

Another advantage of the use of the stamping technique where the liner has been pre-applied to the billet is the fact that the pressure can be applied to the liner more consistently over the large surface area of the billet 10 containing many bushes 1 as opposed to just on a single bush 1.

There is an additional advantage in that manufacturing the bushes from a reasonably sized, if not large, billet, is far preferable from a handling point of view to manufacture the bushes on an individual piece-by-piece basis.

In the present specification "comprises" means "includes or consists of" and "comprising" means "including or consisting of".

15

The features disclosed in the foregoing description, or the following claims, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for attaining the disclosed result, as appropriate, may, separately, or in any combination of such features, be utilised for realising the invention in diverse forms thereof.

20

CLAIMS:

1. A method of manufacturing a bush from a blank comprising the steps of:
providing a blank having a surface to be lined and at least one spigot
5 upstanding from the surface;
providing a liner having an aperture;
locating the aperture in the liner around the spigot such that the liner lies on the
surface; and
stamping out the blank around the spigot to provide a lined and flanged bush.
10
2. A method according to Claim 1, wherein the step of stamping includes
the step of cutting through the liner and then into at least part of the blank.
3. A method according to Claim 1 or 2, wherein the step of stamping
15 comprises cutting completely through the blank.
4. A method according to any preceding claim, wherein the blank is
stamped from the side of the blank provided with the liner.
- 20 5. A method according to any preceding claim, wherein the liner is bonded
to the surface prior to stamping.
6. A method according to Claim 5, wherein pressure is applied to the liner
prior to stamping to assist consistent bonding of the liner to the surface.
25
7. A method according to any preceding claim, wherein the liner around
the spigot is spaced apart from the spigot by a clearance gap.

8. A method according to any preceding claim, wherein a plurality of spigots are provided on the blank and the liner is provided with at least a corresponding number of apertures, wherein the apertures are located around respective spigots such that the liner lies on the surface and the step of
5 stamping out the blank around the spigot to provide a flanged bush is carried out simultaneously for all the spigots so as to provide a plurality of lined and flanged bushes from one stamping operation.
9. A method according to Claim 8, wherein the spigots are provided on the
10 blank in a regular array.
10. A method according to any preceding claim, wherein the blank is machined to provide the or each spigot, the or each spigot having a central bore machined therein.
- 15 11. A method according to any preceding claim, wherein the blank is a billet machined from a bar of material.
12. A method according to any preceding claim, wherein the stamping step
20 provides a mechanical bond between the edge of the liner and the edge of the flange for the or each flanged bush.
13. A flanged bush comprising: a spigot having a flange which provides a flange surface surrounding the spigot; and a liner having an aperture through
25 which the spigot is located, wherein there is an adhesive bond between the flange surface and the liner and a mechanical bond between an outer edge of the liner and the edge of the flange.

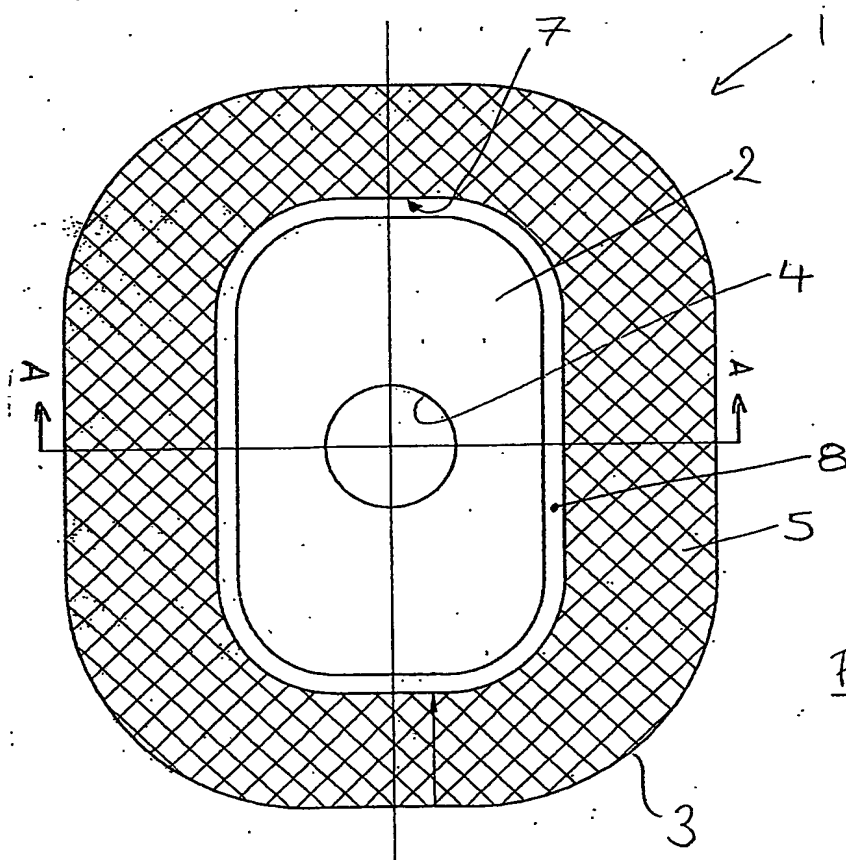
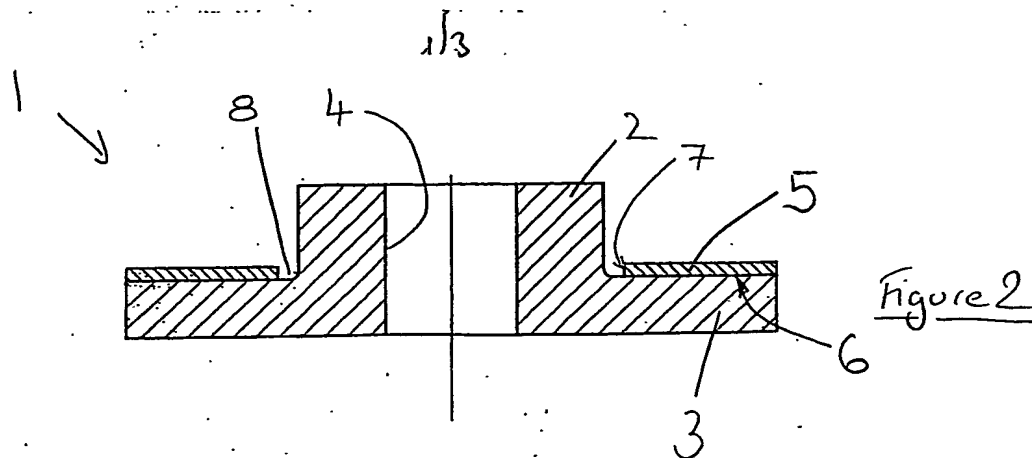
14. A method of manufacturing a bush substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

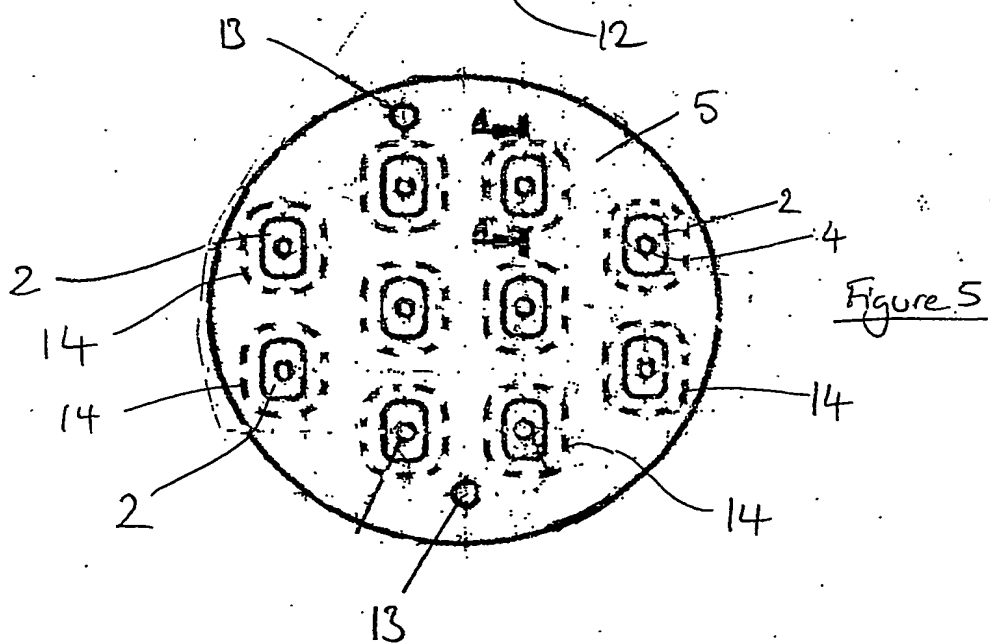
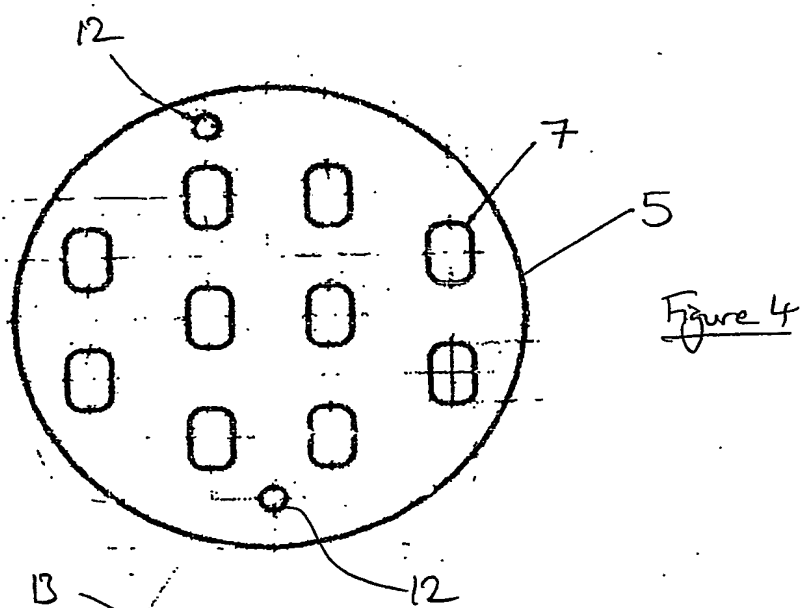
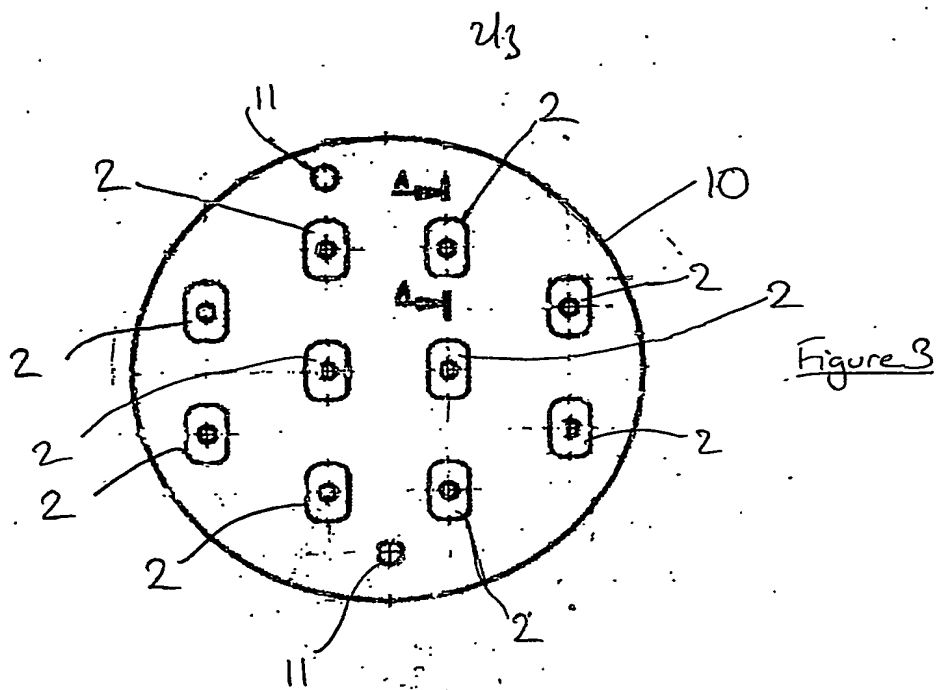
15. A flanged bush substantially as hereinbefore described with reference to
5 and as shown in the accompanying drawings.

16. Any novel feature or combination of features as hereinbefore described.

ABSTRACT

A lined and flanged bush and method of manufacturing the same comprising the steps of: providing a liner having an aperture; locating the aperture in the
5 liner around the spigot such that the liner lies on the surface; and stamping out the blank around the spigot to provide a lined and flanged bush.





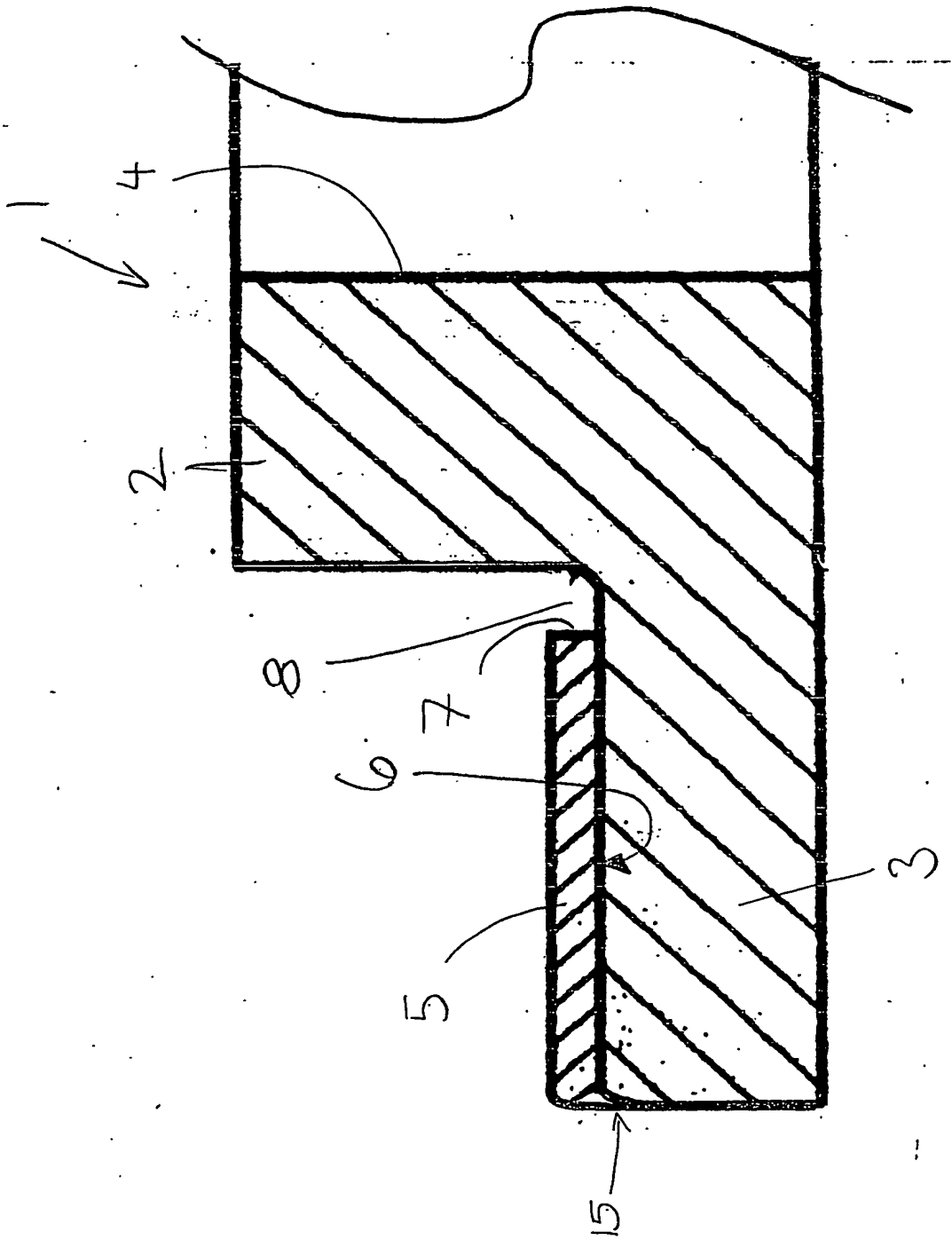


Figure 6

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